

**Riparian Aquatic Species Inventory
Pinnacles National Monument
2001-2002**

Progress Report
February 2004

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Prepared for the
San Francisco Bay Area Inventory and Monitoring Network
National Park Service

EXECUTIVE SUMMARY

The waters of Pinnacles National Monument were surveyed for the purposes of an inventory of riparian aquatic vertebrate and invertebrate species in 2001-2003. Surveys for vertebrates consisted of walking all stretches of appreciable streams and recording observations of fish and aquatic amphibians, and reptiles. Invertebrates were sampled using several methods, including the California Rapid Bioassessment Protocol, kick nets, dip nets, aerial sweep nets, and black light traps. Invertebrate survey sites were selected to represent the range of riparian aquatic habitats found at Pinnacles. Species of concern recorded during the surveys include California red-legged frog (*Rana draytonii*), Southern Pacific pond turtle (*Clemmys marmorata pallida*), Pinnacles riffle beetle (*Optioservus canus*), and the exotic mosquitofish (*Gambusia affinis*). For the Federally Threatened California red-legged frog, detailed habitat use and life history information was recorded. A total of 8 aquatic vertebrate species were recorded in the Monument, consisting of 2 fish, 3 amphibians, and 3 reptiles.

Identifications are pending for the aquatic invertebrates, although their diversity appears to be high for the types of habitats found at Pinnacles. As an example of the diversity of aquatic invertebrates at Pinnacles and the value of this inventory for advancing our knowledge of this resource, we more than doubled the number of dragonflies and damselflies known to occur in San Benito County, from 15 to at least 35.

INTRODUCTION

Pinnacles National Monument is located in San Benito and Monterey Counties, at the southern end of the Gabilan Range in Central California's Inner Coast Ranges. It falls entirely within the Salinas River watershed. The vegetation is dominated by chaparral, with small areas of grassland, oak woodland, and riparian habitat. Although riparian habitat encompasses only a small percentage of the Pinnacles landscape, it is vital to the survival of many plant and animal species, both terrestrial and aquatic.

Because of the steep terrain of the Monument, most of the buildings, parking lots, roads, and trails are located in the flatter riparian areas. These structures, as well as accompanying structures such as bridges, culverts, and rock walls, have the potential to negatively impact natural stream processes. Furthermore, the concentration of visitor use in riparian areas increases the potential for pollution to enter the streams, and for direct impacts from visitors such as road kills and trampling or collecting of aquatic wildlife and vegetation. Potential impacts on Pinnacles streams are not limited to sources within the Monument. The headwaters of most of Pinnacles' streams are located outside of the Monument's boundaries. Human activities and developments in these areas include cattle ranching, vineyards, a campground, and a small reservoir which supports exotic invasive aquatic species.

Despite these factors, Pinnacles' aquatic ecosystems appear to be relatively healthy, and as such they may be useful as a baseline for comparison with other

similar areas. The majority of Pinnacles streams are ephemeral, so the fact that ephemeral streams have not been studied as extensively as perennial streams adds to the value of studying Pinnacles' aquatic ecosystems. And because aquatic organisms are excellent indicators of water quality and overall stream health, the information gathered from this study will form the baseline for future water quality and long-term stream ecosystem monitoring efforts.

Our historic knowledge of Pinnacles' fish and aquatic amphibians and reptiles is based on several resources, including a report by the Park Naturalist in the late 1950's (Wauer 1958), surveys by Morafka and Banta (1972, 1976), surveys conducted in the early 1990's (Ely 1994), and surveys conducted in the late 1990's by Pinnacles National Monument staff (Johnson 1999, 2001). Our historic knowledge of Pinnacles' aquatic invertebrates is based mainly on limited published literature, surveys and observational reports.

Table 1. Historic records of riparian aquatic species at Pinnacles National Monument.

GROUP	SCIENTIFIC NAME	COMMON NAME	COMMENTS	REFERENCE
Fish	<i>Gasterosteus aculeatus</i>	threespine stickleback	native to PINN	Chandler 1954b
Fish	<i>Gasterosteus aculeatus</i>	threespine stickleback	in reservoir	Murray and Christiano 1976?
Fish	<i>Gasterosteus aculeatus</i>	threespine stickleback	in reservoir, Chalone Creek	Chappell and Eimoto 1979
Fish	<i>Lepomis cyanellus</i>	green sunfish	widespread, abundant	Chappell and Eimoto 1979
Fish	<i>Pimephales promelas</i>	fathead minnow	Chalone Creek	Chappell and Eimoto 1979
Fish	<i>Archoplites interruptus</i>	Sacramento perch	Chalone Creek, ID by Peter Moyle	Ely 1994
Fish	<i>Gambusia affinis</i>	mosquitofish	abundant in S. Wilderness	Ely 1994
Amphibian	<i>Bufo boreas</i>	Western toad	Chalone Creek, rare	Banta and Morafka 1968
Amphibian	<i>Hyla regilla</i>	Pacific tree frog	widespread, abundant	Banta and Morafka 1968
Amphibian	<i>Rana draytonii</i>	California red-legged frog	common at reservoir; Chalone Creek, Bear Gulch Cave	Banta and Morafka 1968
Amphibian	<i>Rana draytonii</i>	California red-legged frog	adults, tadpole in reservoir	Murray and Christiano 1976?
Reptile	<i>Clemmys marmorata pallida</i>	Southern Pacific pond turtle	North Wilderness	Banta and Morafka 1968
Reptile	<i>Thamnophis atratus zaxanthus</i>	Diablo Range garter snake		Fitch 1940
Reptile	<i>Thamnophis sirtalis</i>	common garter snake	widespread, common	Banta and Morafka 1968
Diptera	<i>Simulium argus</i>	black fly	Bear Creek, Chalone Creek	Coleman 1953

Diptera	<i>Simulium piperi</i>	<i>Simulium argus</i>	Bear Gulch	Coleman 1953
Diptera	<i>Simulium canadense</i>	<i>Simulium argus</i>	Chalone Creek	Coleman 1953
Diptera	<i>Prosimulium dicum</i>	<i>Simulium argus</i>	Chalone Creek	Coleman 1953
Diptera	<i>Lipoptena depressa</i>		Chalone Creek	Coleman 1953
Hemiptera	<i>Hebrus sobrinus</i>			Chandler 1954b
Hemiptera	<i>Merragata hebroides</i>			Chandler 1954b
Hemiptera	<i>Ambrysus californicus</i>			Chandler 1954b
Hemiptera	<i>Ranatra brevicollis</i>	water scorpion		Chandler 1954b
Hemiptera	<i>Sigara</i> sp.			Chandler 1954b
Megaloptera	<i>Neohermes</i> sp.	dobsonfly		Chandler 1954b
Megaloptera	<i>Sialis new</i> sp.	alderfly		Chandler 1954b
Coleoptera	<i>Peltodytes simplex</i>			Chandler 1954b
Coleoptera	<i>Hydroporus palliatus</i>			Chandler 1954b
Coleoptera	<i>Hydroporus villis</i>			Chandler 1954b
Coleoptera	<i>Hydroporus bidessoides</i>			Chandler 1954b
Coleoptera	<i>Deronectes striatellus</i>			Chandler 1954b
Coleoptera	<i>Agabus regularis</i>			Chandler 1954b
Coleoptera	<i>Agabus illybiiformis</i>			Chandler 1954b
Coleoptera	<i>Gyrinus plicifer</i>	whirligig beetle		Chandler 1954b
Coleoptera	<i>Hydraena vandykei</i>			Chandler 1954b
Coleoptera	<i>Limnebius piceus</i>			Chandler 1954b
Coleoptera	<i>Octhebius martini</i>			Chandler 1954b
Coleoptera	<i>Octhebius costipennis</i>			Chandler 1954b
Coleoptera	<i>Octhebius discretus</i>			Chandler 1954b
Coleoptera	<i>Tropisternus ellipticus</i>			Chandler 1954b
Coleoptera	<i>Anacaena signaticollis</i>			Chandler 1954b
Coleoptera	<i>Laccobius ellipticus</i>			Chandler 1954b
Coleoptera	<i>Laccobius californicus</i>			Chandler 1954b
Coleoptera	<i>Cymyiodyta dorsalis</i>			Chandler 1954b
Coleoptera	<i>Helochares normatus</i>			Chandler 1954b
Coleoptera	<i>Helichus productus</i>			Chandler 1954b
Coleoptera	<i>Helichus productus</i>			Shepard 1990
Coleoptera	<i>Helichus striatus</i>			Shepard 1990
Coleoptera	<i>Helichus suturalis</i>			Chandler 1954b
Coleoptera	<i>Helichus suturalis</i>			Shepard 1990
Coleoptera	<i>Optioservus canus</i>	Pinnacles riffle beetle	Holotype Chalone Creek	Chandler 1954a
Coleoptera	<i>Optioservus canus</i>	Pinnacles riffle beetle	Chalone Creek, and elsewhere in San Benito and Monterey Co.	Shepard 1990
Coleoptera	<i>Hydrocara lineata</i>		Chalone Creek	De Foe 1963
Coleoptera	<i>Eubrianax edwardsii</i>	Water penny		Shepard 1990

The main objectives of this study were to do the following for Pinnacles National Monument:

- Produce a complete list and voucher collection of fish species.
- Create GIS coverages of distributions of fish and aquatic amphibian and reptile species.
- Create GIS coverages of California red-legged frog distribution by each life cycle component (eggs, tadpoles, and adults).
- Describe habitat preferences of red-legged frogs.
- Produce a species list and voucher collection of aquatic invertebrates.
- Determine aquatic invertebrate community composition in relation to water quality conditions.
- Determine status and distribution of the endemic Pinnacles riffle beetle.

METHODS

--Vertebrates

Surveys for vertebrates were conducted in most stretches of stream with enough water to support amphibian breeding. Surveyors walked in or beside the stream, recording all herp and fish species encountered. Surveyors gauged their effort level to find every species present, but not every individual present. In general, surveyors walked slowly enough to allow them to determine the numbers of individuals readily seen. A dip net was used to flush animals, and to sample a portion of areas not readily visible, such as beneath undercut banks or floating vegetation. An attempt was made to minimize habitat disturbance while walking and while flushing animals from in or beside the stream. If a section was completely covered with floating vegetation, a window was cleared in the vegetation and then an attempt was made to flush animals into view from obscured areas.

The primary goal was to establish presence/absence of species and their reproduction in sections of creek. Information was also collected on numbers and life stages present. Only the number of individuals actually observed was recorded, along with proportions in each size/age class. Tadpoles and fish were generally too numerous to count individually, so numbers of these were estimated when necessary. However, total numbers were never inferred from a subsample observed. If it seemed that many more were present, surveyors continued surveying the area to get a better idea of what was there. If a section was too difficult to survey sufficiently, or if doing so would have significantly disturbed habitat, it was noted that many more were suspected to be present.

While walking along the creek, surveyors scanned from their feet to as far ahead as they could see. When they approached habitat that appeared to be prime for California red-legged frog or Southern Pacific pond turtle, they used binoculars to scan the area before approaching it. They also listened for the sounds of animals jumping into the creek, and identified them whenever possible. They did not make an effort to look for animals more than one meter away from the edges

of the creek, but when their movement alerted the surveyor to their presence, they were recorded. For most species, observations were summarized for each stream reach, following the morphological stream reach definitions created by Chad Moore, Park Physical Scientist. For the Southern Pacific pond turtle and the California red-legged frog, locations were recorded with a GPS unit.

Fish and amphibians were generally not captured. Turtles and snakes were often captured for identification and measurement.

--Invertebrates

Aquatic macroinvertebrates were sampled using a variety of methods. The majority of samples were collected with a combination of techniques designed to sample all major microhabitats at each site. These sites were selected to represent the range of riparian aquatic habitats found at Pinnacles. Kick nets were used to sample the substrate. Dip nets were used to sample within the water column, in aquatic vegetation, beneath undercut banks, and on the water surface. Forceps and aspirators were used to sample shorelines. At each site, invertebrates were placed into a flat, white plastic pan as they were collected. Sites were sampled until no obviously new morphospecies were collected. Invertebrates in the pan were then picked through to remove large debris and excessive multiples of the same morphospecies. The final sample containing several specimens of each morphospecies was then placed into a Whirlpak bag with 95% ethanol. The amount of water contained in the sample was enough to bring the alcohol concentration in the bag down to approximately 70%. These samples were sent to Robert Wisseman at Aquatic Biology Associates, Inc. for identification, with the exception of a set of samples collected in Summer, 2003 that were sent to Jon Lee.

Another set of samples was collected with kick nets following the California Rapid Bioassessment Protocol (RBP). The RBP only applies to riffles in the spring of the year, and samples were not necessarily analyzed to inventory every species contained in them, but they still provide valuable species presence and distribution data. RBP samples were preserved in ethyl alcohol and sent to Jon Lee for identification.

Aerial nets were used to collect winged adults of aquatic invertebrates, mainly dragonflies and damselflies (Odonates). These were collected during trips targeted to specific times and habitats, as well as opportunistically while performing other tasks in the field. A few Odonates were also collected after they emerged as adults in pens used for rearing California red-legged frogs. Odonates were either pinned, or they were dried in acetone and placed in plastic envelopes with index cards. All Odonates were sent to Andy Rehn for identification. Other winged adults were either pinned or placed in 70% ethyl alcohol and sent to Robert Wisseman.

On the suggestion of Robert Wisseman, black light traps (Bioquip Products, catalog #2851) were also used to collect winged adults, especially caddisflies. A few winged adults were also collected at lights at buildings at Park Headquarters. These specimens were sent to Robert Wisseman for identification. Most of these specimens were preserved in ethyl alcohol, and a few were pinned.

RESULTS AND DISCUSSION

--Vertebrates

A total of 8 riparian aquatic vertebrate species were recorded in the Monument, consisting of 2 fish, 3 amphibians, and 3 reptiles (Table 2). Two of these species (Western toad and Southern Pacific pond turtle) were not observed during stream surveys, but were observed at other times during the study period. Results of stream surveys are presented in Tables 3a-d, with data presented by stream stretches as defined in Figure 1.

Table 2. Riparian aquatic vertebrate species observed at Pinnacles National Monument during 2001-2002.

Scientific Name	Common Name
<i>Gasterosteus aculeatus</i>	threespine stickleback
<i>Gambusia affinis</i>	mosquitofish
<i>Rana draytonii</i>	California red-legged frog
<i>Hyla regilla</i>	Pacific tree frog
<i>Bufo boreas</i>	Western toad
<i>Clemmys marmorata</i>	Southern Pacific pond turtle
<i>Thamnophis sirtalis</i>	common garter snake
<i>Thamnophis atratus zaxanthus</i>	Diablo Range garter snake

Figure 1. Map of Pinnacles National Monument showing stream section definitions used in Tables 3a-d.

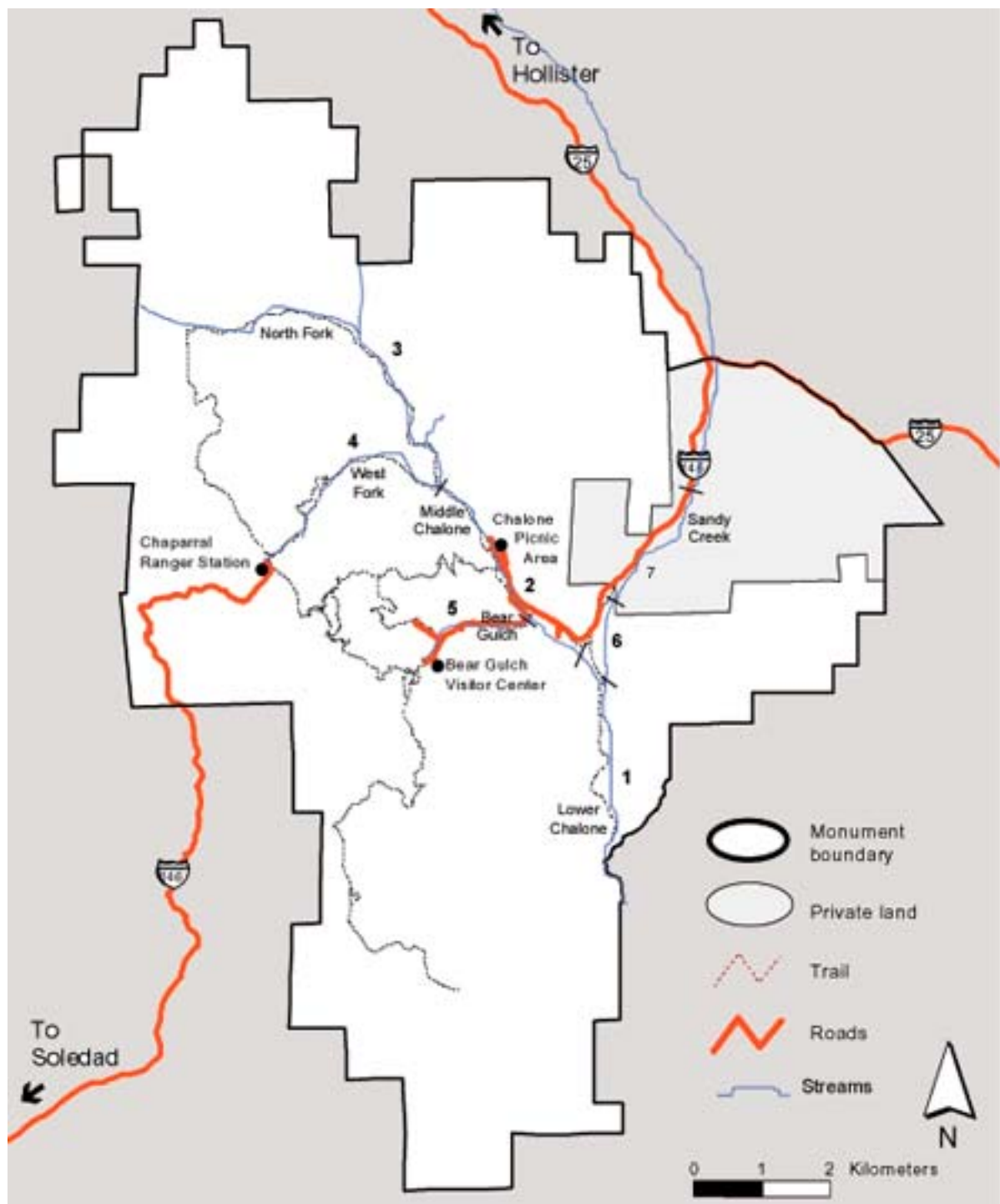


Table 3a. Results of Spring 2001 riparian aquatic vertebrate survey. Stream section numbers refer to Figure 1.

Spring 2001		Stream Section							
Common Name	Life Stage	1	2	3	4	5	6	7	Total
threespine stickleback		853	4000	500		970			6323
mosquitofish		1698							1698
Pacific tree frog	Egg								
	Tadpole	104	195	110	150	140			699
	Metamorph	2							2
	Juvenile								
	Adult								
California red-legged frog	Egg								
	Tadpole	43							43
	Metamorph								
	Juvenile	9							9
	Adult	10				1			11
	??	2							2
Diablo Range garter snake									
common garter snake		5	1	1		2			9
Unidentified garter snake		1		1					2

Table 3b. Results of Fall 2001 riparian aquatic vertebrate survey. Stream section numbers refer to Figure 1.

[illegible]

Threespine sticklebacks and the invasive exotic mosquitofish were abundant in lower Chalone Creek. Threespine sticklebacks were common to uncommon in spotty locations in Bear Gulch and middle Chalone Creek. A yearly pattern was observed in which mosquitofish are present in relatively small numbers in the lower Chalone Creek, and by fall their numbers have increased and they have worked their way upstream.

An infestation of more than 3600 invasive exotic green sunfish was eradicated from the Monument in 1998-1999 (Johnson 1999). This species was not observed during surveys in 2001-2002.

California red-legged frog reproduction was documented and locations of all life stages were recorded. Populations were concentrated in lower Chalone Creek, on private land in Sandy Creek, and in the Bear Gulch Reservoir (a result of re-establishment efforts). California red-legged frog habitat preferences in streams at Pinnacles appear to differ considerably from descriptions in the published literature, perhaps in part due to the sparsity of deep stream pools.

Pacific tree frogs were common throughout riparian areas of the park, with breeding abundant, widespread, and prolonged throughout much of the spring and summer.

Western toads were not observed during surveys. Although 2001 and 2002 were only slightly drier than average, winter and spring weather patterns resulted in streams drying up at least a month ahead of usual. The slow, shallow sections of Middle Chalone Creek and the North Fork where Western toads often breed were dry by the time of the spring surveys. However, Western toad reproduction was documented in 2001 in middle Chalone Creek and in a stock pond on the privately owned Pinnacles Ranch adjacent to the Monument. Estimated oviposition dates were 1 April and 10 March, respectively. Adults were seen opportunistically throughout the Monument, even at great distances from riparian areas.

Southern Pacific pond turtles were not encountered on surveys. They were, however, encountered opportunistically, always in areas with deep and/or year-round water.

Common garter snakes, as their name suggests, were commonly found in riparian areas, especially in combination with Pacific tree frog tadpoles. They were widespread throughout riparian areas, and likely range away from water.

A single Diablo Range garter snake was seen in Spring 2002 in lower Chalone Creek. This species is likely found only near perennial water.

--*Invertebrates*

Although most of the aquatic macroinvertebrate specimens are still being identified, their diversity appears to be high, especially for an area dominated by intermittent streams. Preliminary results are presented in Table 4.

Table 4. Preliminary list of aquatic macroinvertebrates collected at Pinnacles National Monument in 2001-2002. Preliminary identifications by Robert Wisseman, Aquatic Biology Associates, Inc.

Non-insects		
Turbellaria	Turbellaria	flat worms
Nematoda	Nematoda	round worms
Nematomorpha	Nematomorpha	horse hair worms
Oligochaeta	Annelida	segmented worms
Hirudinea	Annelida	leeches
Lymnaeidae	Gastropoda	snails
Physella	Gastropoda, Physidae	snails
Planorbidae	Gastropoda	scuds
<i>Hyalella probably azteca</i>	Crustacea, Amphopoda	mites
Acarina	Arthropoda	
Ephemeroptera (mayflies)		
<i>Ameletus</i>	Ameletidae	
<i>Baetis tricaudatus</i>	Baetidae	
<i>Callibaetis</i>	Baetidae	
<i>Fallceon quilleri</i>	Baetidae	
<i>Caenis</i>	Caenidae	
<i>Paraleptophlebia</i>	Leptophlebiidae	
<i>Tricorythodes</i>	Tricorythidae	
Odonata (damselflies and dragonflies)		
<i>Hetaerina americana</i>	Calopterygidae	
Coenagrionidae	Coenagrionidae	
<i>Argia probably vivida</i>	Coenagrionidae	
<i>Enallagma</i>	Coenagrionidae	
<i>Archilestes californica</i>	Lestidae	

<i>Aeshna walkeri</i>	Aeshnidae	
<i>Anax junius</i>	Aeshnidae	
<i>Cordulegaster dorsalis</i>	Cordulegasteridae	
<i>Erpetogomphus compositus</i>	Gomphidae	
<i>Octogomphus specularis</i>	Gomphidae	
<i>Progomphus borealis</i>	Gomphidae	
Libellulidae	Libellulidae	
<i>Libellula saturata</i>	Libellulidae	
<i>Palaethemis lineatipes</i>	Libellulidae	
<i>Plathemis lydia</i>	Libellulidae	
<i>Sympetrum illotum</i>	Libellulidae	
Orthoptera (grasshoppers & crickets)		
Tetrigidae	grouse or pygmy locusts	
Tridactylidae	pygmy mole crickets	
Plecoptera (stoneflies)		
Capniidae	Capniidae	
<i>Sweltsa</i>	Chloroperlidae	
Nemouridae-female adult	Nemouoridae	
<i>Malenka</i>	Nemouoridae	
Perlodidae near Osobenus	Perlodidae	
<i>?Oemopteryx</i>	Taneniopterygidae	
Hemiptera (true bugs)		
Abedus	Belostomatidae	
Belostoma	Belostomatidae	
Corixidae	Corixidae	
<i>Gelastocoris</i>	Gelastocoridae	
<i>Gerris</i>	Gerridae	
<i>Trepobates</i>	Gerridae	

<i>Hebrus</i>	Hebridae	
<i>Macrovelia</i>	Macroveliidae	
<i>Ambrysus</i>	Naucoridae	
<i>Ranatra</i>	Nepidae	
<i>Buenoa</i>	Notonectidae	
<i>Notonecta</i>	Notonectidae	
<i>Microvelia</i>	Veliidae	
<i>Rhagovelia</i>	Veliidae	
Megaloptera (alderflies and hellgramites)		
<i>Neohermes</i>	Corydalidae	
<i>Sialis</i>	Sialidae	
Trichoptera (caddisflies)		
<i>Micrasema</i>	Brachycentridae	
<i>Hydropsyche</i>	Hydropsychidae	
<i>Parapsyche ?almota</i>	Hydropsychidae	
<i>Hydroptila</i>	Hydroptilidae	
<i>Lepidostoma Pluviale Group</i>	Lepidostomatidae	
<i>Lepidostoma-turret case</i>	Lepidostomatidae	
<i>Nectopsyche</i>	Leptoceridae	
<i>Ylodes</i>	Leptoceridae	
<i>Dolophilodes</i>	Philopotamidae	
<i>Polycentropus</i>	Polycentropodidae	
<i>Tinodes</i>	Psychomyiidae	
<i>Gumaga</i>	Sericostomatidae	
Coleoptera (beetles)		
Cicindelidae	Cicindelidae	
<i>Helichus</i>	Dryopidae	
<i>Postelichus</i>	Dryopidae	

Dytiscidae	Dytiscidae	
<i>Optioservus</i>	Elmidae	
<i>Gyrinus</i>	Gyrinidae	
<i>Haliphus</i>	Haliplidae	
<i>Peltodytes</i>	Haliplidae	
Hydraenidae	Hydraenidae	
Hydrophilidae	Hydrophilidae	
<i>Berosus</i>	Hydrophilidae	
<i>Psephenus</i>	Psephenidae	
Diptera (true flies)		
<i>Dasyhelea</i>		
<i>Chaoborus</i>	Ceratopogonidae	
Chironomidae	Chaoboridae	
Culicidae	Chironomidae	
<i>Dixella</i>	Culicidae	
<i>Meringodixa</i>	Dixidae	
Ephydriidae	Dixidae	
<i>Limnophora</i>	Ephydriidae	
<i>Simulium</i>	Muscidae	
<i>Caloparyphus</i>	Simuliidae	
<i>Euparyphus</i>	Stratiomyidae	
<i>Odontomyia</i>	Stratiomyidae	
Tabanidae	Stratiomyidae	
<i>Dicranota</i>	Stratiomyidae	
<i>Hexatoma</i>	Tabanidae	
<i>Limonia</i>	Tipulidae	
<i>Tipula</i>	Tipulidae	
	Tipulidae	
	Tipulidae	

Extra attention was focused on Odonates because they are the charismatic megafauna of the aquatic macroinvertebrate world. The existence of web sites and popular field guides for Odonates makes them ideal for interpreting riparian aquatic macroinvertebrates to the public. At least 35 species of Odonates were found (15 were known from San Benito County prior to this study). A web page on the Odonata of Pinnacles, including a checklist (Table 5), has been posted on the Pinnacles NPS website.

Table 5. Dragonflies and Damselflies of Pinnacles National Monument, based on surveys in 2001-2003. Identifications by Andy Rehn, Ph.D.

Scientific Name	Common Name
Suborder ANISOPTERA	DRAGONFLIES
Family Aeshnidae	Darners
<i>Anax junius</i>	Common Green Darner
<i>Anax walsinghami</i>	Giant Darner
<i>Aeshna multicolor</i>	Blue-Eyed Darner
* <i>Aeshna californica</i>	California Darner
<i>Aeshna walkeri</i>	Walker's Darner
Family Gomphidae	Clubtails
<i>Octogomphus specularis</i>	Grappletail
<i>Progomphus borealis</i>	Gray Sanddragon
<i>Erpetogomphus compositus</i>	White-Belted Ringtail
Family Cordulegastridae	Spiketails
<i>Cordulegaster dorsalis</i>	Pacific Spiketail
Family Libellulidae	Skimmers
<i>Libellula lydia</i>	Common Whitetail
<i>Libellula saturata</i>	Flame Skimmer
<i>Paltothemis lineatipes</i>	Red Rock Skimmer
<i>Sympetrum illotum</i>	Cardinal Meadowhawk
<i>Sympetrum corruptum</i>	Variegated Meadowhawk
<i>Pachydiplax longipennis</i>	Blue Dasher
<i>Erythemis collocata</i>	Western Pondhawk
<i>Pantala flavescens</i>	Wandering Glider
<i>Pantala hymenaea</i>	Spot-Winged Glider
<i>Tramea lacerata</i>	Black Saddlebags
<i>Brechmorhoga mendax</i>	Pale-Faced Clubskimmer
Suborder ZYGOPTERA	
Family Calopterigidae	

previously thought, most of its known population at Pinnacles is in Chalone Creek downstream of Bear Gulch and Sandy Creek. It may therefore be especially vulnerable to water pollution and disturbances to natural stream processes emanating from all current developed areas of the Monument, as well as from many miles of Sandy Creek and the headwaters of Chalone Creek outside the Monument.

TASKS TO BE COMPLETED (Data collected, awaiting further analysis)

- Create GIS coverages of distributions of fish and aquatic amphibian and reptile species.
- Create GIS coverages of California red-legged frog distribution by each life cycle component (eggs, tadpoles, and adults).
- Describe habitat preferences of red-legged frogs.
- Produce a species list of aquatic invertebrates.
- Determine aquatic invertebrate community composition in relation to water quality conditions.

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